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A CYCLOCONVERTER POWER SUPPLY FOR THE B.K. TRANSDUCER.(U)
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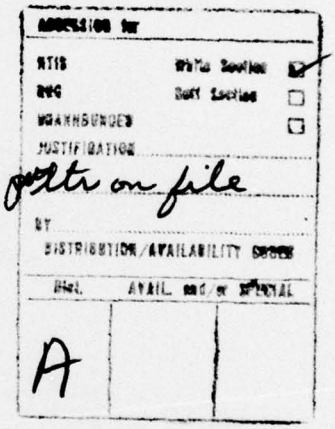
A CYCLOCONVERTER POWER SUPPLY FOR THE B. K. TRANSDUCER.

This Technical Memorandum is written to provide a guide in installation and servicing for the B. K. Sound Source and does not represent the official opinion of the Laboratory.



CYCLOCONVERTER OPERATION AND CIRCUIT DESCRIPTION.

The cycloconverter is an arrangement of two multi-phase rectifiers that permits sampling of the 60 Hz, 3-phase line voltage and converts this to a lower frequency, single phase voltage. Figure 1 is a block diagram of the system. 3-phase, 440 volt power is taken from the ship, transformed by T5. Final output power is set by the voltage tap chosen. Alternate halves of the cycloconverter, Phase I, Phase II, are permitted to conduct by application of a burst of pulses to all the gates in one particular phase. Each half of the low frequency wave is then produced by conduction in one-half of the cycloconverter. Balancing reactors and resistors (A2-T1-T2-R1-R2) prevent short circuit currents from circulating between the two halves should one fail to shut off at the end of a half-cycle. Within the transducer a diode bridge (A3 CR1,2,3,4) forces unidirectional current flow through one set of plates (A3 R1) while allowing alternating directional flow through the other set of plates (A3 R2). The voltage applied to the B.K. is not amplitude modulated, except for line ripple and switching transients.

Gate control signals for the 12 controlled rectifiers (A1 CR1-12) are derived from the pulse generator of figure 2 through a 12 pair conductor and connector, P-2. Six identical Gate Pulse Drivers, three associated with Phase I and three with Phase II, apply turn-on signals for the controlled rectifiers. Each Gate Pulse Driver is quiescent until it receives a pulse from its associated Oscillator Driver. These latter drivers are themselves quiescent until a positive signal at the base of (A1 Q1, A2 Q1) allows the unijunction transistor (A1,A2-Q2) to oscillate freely at about 1000 PPS. A low frequency signal from an external oscillator applied to T2 will develop a two-phase signal which alternately turns on the two Oscillator Drivers at the desired low frequency (f).

MALFUNCTION LOCALIZATION

Most difficulties can be isolated within the transducer, cycloconverter, or gate pulser by means of a few systematic checks.

COMPLAINT	LOCATION	CHECK PROCEDURE
1. No transducer signal	Open leads to BK No AC to pulser Open fuse in cyclo No oscillator signal or insufficient signal Open or shorted diode within BK.	Ohmmeter check of BK.
2. Cyclo draws excess current or won't shut off.	Shorted SCR	Check resistance with ohmmeter after lifting all gate and cathode leads
	Gate Pulser locked on	Shut off AC to pulser and reapply 3-phase to cyclo. Using 2 current probes check for no overlap in gate pulses to phase 1 and phase 11.
	BK shorted internally or to external shell	Ohmmeter to ground

CHECKING PROCEDURES

1. Transducer shorts

If one of the internal diodes has shorted, an ohmmeter check at the external terminals will show differing values if the probes are reversed. Also, an open diode will show this:

If the two sets of plates are shorted the BK must be opened, the two leads from the internal rectifier bridge removed, and a resistance test between

the two sets of plates made.

2. SCR Shorts

After all gate and cathode leads have been lifted an ohmmeter will indicate a low resistance in one direction or the other. Often a usable SCR will show a resistance as low as 50k. Open SCR is indicated by a notch in the output waveform. Let gate pulser run; lift large cathode lead; then check for anode to cathode conduction with ohmmeter.

3. Pulser misfire

The gate pulser can be checked for correct operation connected or separated from cycloconverter. A current probe similar to the Tektronix Type P 6016 will allow the individual gate currents to be examined in place. A peak current amplitude in excess of one amp with a width at half amplitude of about 10 μsec is desired. Two probes, one attached to a gate in each phase will show any overlap in the gate pulses of the two parts of the cycloconverter. A common fault will be the continuous operation of one set of Gate Pulse Drivers. This will be due to one of the Oscillator Drivers running continuously.

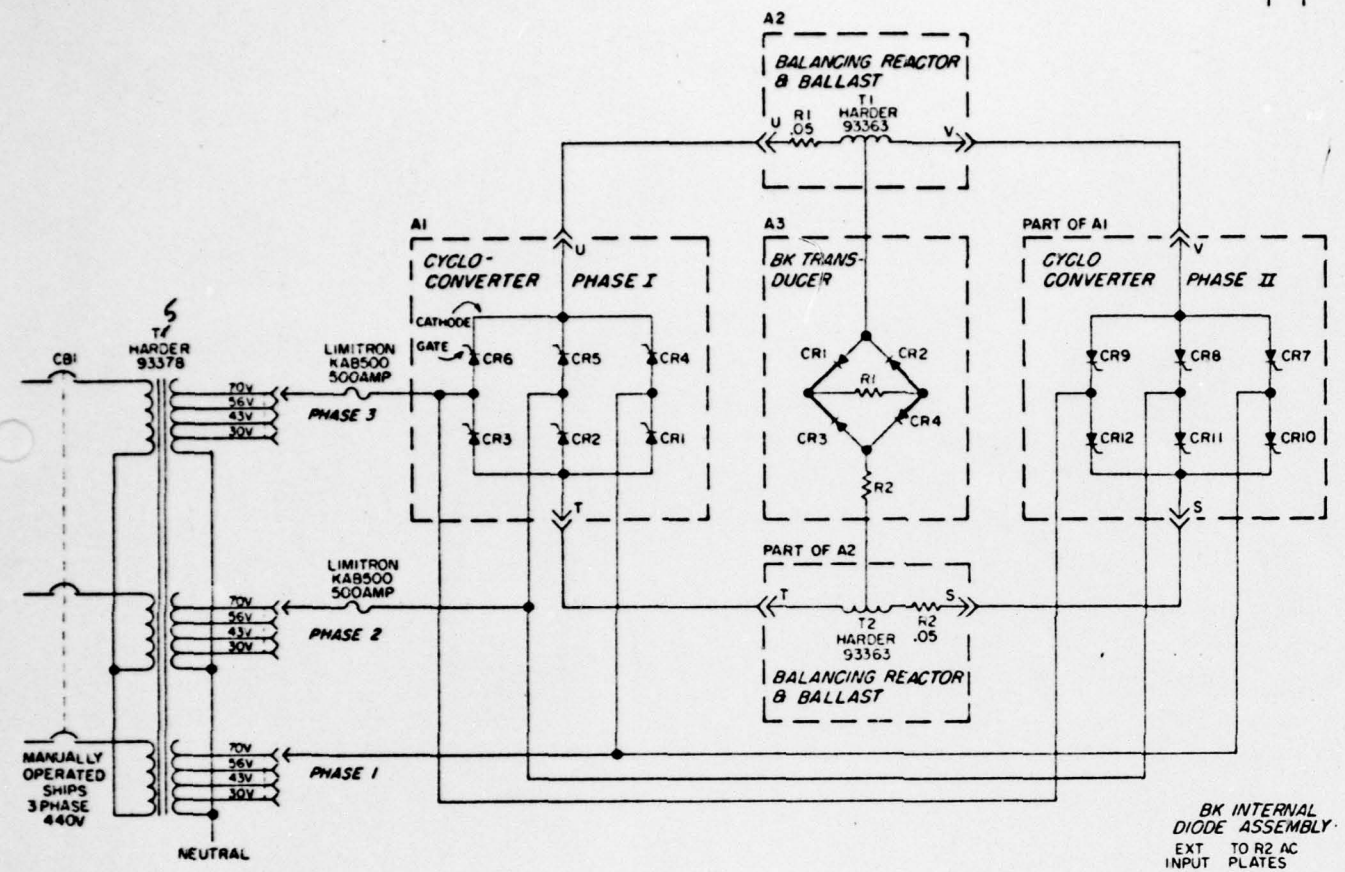
A convenient method of checking the pulse system is to insert a shorting plug in P2. This substitutes a short piece of wire for each SCR gate and provides a convenient place to attach the current probes.

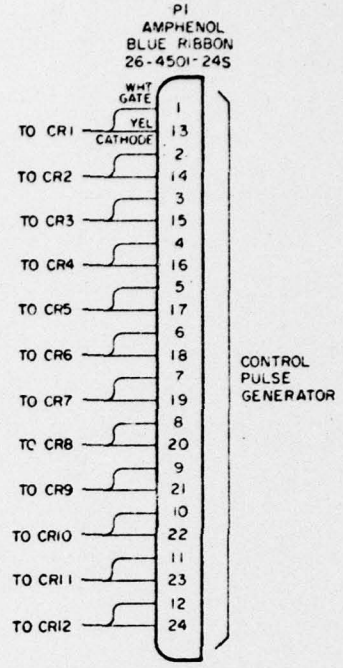
Gate Pulse Drivers should yield no output with no low frequency signal present. Again the current probe will indicate a free running driver if it continues to run after the two Oscillator Cards are removed. Replacement of the 4-layer diode is usually sufficient remedy. This is also the treatment for a Gate Driver that will not go on.

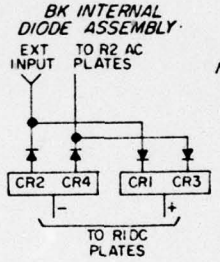
CYCLOCONVERTER OPERATION AND CIRCUIT DESCRIPTION (CONTINUED)

Each of the functions within the Cycloconverter Gate Pulser as shown in figure 2 is separated on plug-in cards. Wire color and receptacle letter designations are called out on the figure.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED







NOTES:
1. WIRES FROM AMPHENOL BLUE RIBBON TO CR1 THRU CR12 ARE GATES, WHT & CR13 THRU CR24 ARE CATHODE. YEL
2. CYCLOCONVERTER PHASE I & PHASE II, CR1 THRU CR12 ARE WESTINGHOUSE 224H, 2N3357
3. BK TRANSDUCER, CR2 & CR4 ARE MOTOROLA MR1247FBR
   CR1 & CR3 ARE MOTOROLA MR1247FB

UNLESS OTHERWISE SPECIFIED
COMPONENT VALUES ARE:
RESISTORS IN OHMS,
WATTS, ± %
CAPACITORS IN μF
INDUCTORS IN MH

APPLICABLE STANDARDS
ABBREVIATIONS MIL-STD-12
COLOR CODING MIL-STD-681
ELECTRONIC SYMBOLS MIL STD-15
REFERENCE DESIGNATIONS
ASA Y 32.16-1965

APPROVED
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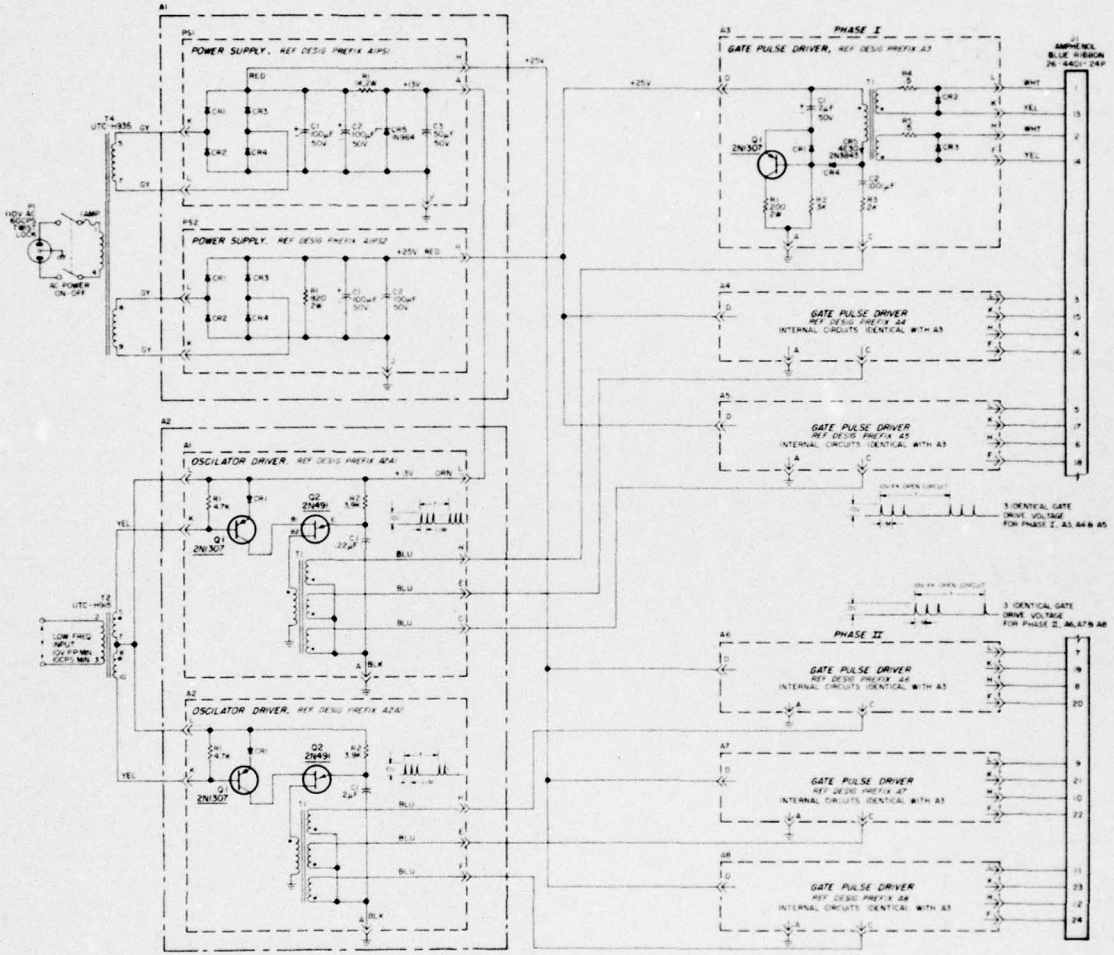
PROB NO. E12071
COGNIZANT CODE 3130

U. S. NAVY ELECTRONICS LABORATORY
SAN DIEGO, CALIFORNIA 92152

CYCLOCONVERTER
BLOCK DIAGRAM

Fig 1

SIZE	CODE IDENT NO		REV
	89199	RAAC21112	
SCALE		SHEET OF	



NOTES: 1. ALL [R] DIODE [] ARE 1N645 UNLESS OTHERWISE SPECIFIED.

2. PARTIAL REFERENCE DESIGNATION SHOWN. SAMPLE A2A2R1

U. S. NAVY ELECTRONICS LABORATORY	
CYCLOCONVERTER GATE PULSER	fig 2
SIZE F	89199 RAAF21102